

WEEDS IN NATIONAL PARKS

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Summary. Weed control in all national parks and conservation reserves is a major management program.

In the past weed control in national parks using commercially available weedicides has been limited, but in recent years greater use of chemicals has been possible with the development of environmentally acceptable products suitable for use in conservation areas.

Weed control in parks is still constrained by financial and legislative demands and the complexity of natural area management issues.

The application of computing techniques to natural area management is assisting the integration of extensive resource data bases with management objectives including the implementation of effective weed control programs.

In many areas weed control is also an integral part of catchment management programs, as many parks fall within or encompass major catchment areas.

INTRODUCTION

Introduced plant species are a major management problem for the managers of national parks and conservation reserves. Weed control in parks imposes greater demands and constraints on park management than on any other sphere of land use. The most easily implemented strategy, or, in some situations the most effective control strategy, is not necessarily the most appropriate within the context of other conservation objectives.

Many other constraints including legislation and financial limitations influence the capacity for and effectiveness of weed control programs in national parks.

PAST CONSTRAINTS ON WEED CONTROL

At the Australian Weeds Conference some ten years ago the problems and concerns of weeds on public lands, particularly national parks, were addressed for the first time in a public forum. The fact that national park weed problems were considered was an indication of the increasing public awareness of environmental issues and the role and objectives of national parks management. It also indicated a broadening of weed research from the purely agricultural and economic aspects to that of weed species ecology and the environmental impacts of exotic species in the natural vegetation landscape.

Due to the traditional and historic orientation of weed research and control methods to agricultural land management, the problems of weed control in parks were considered by those at the conference with reservation and there was a suggestion that little would ever be done about such problems. It was expressed that few if any major weed control programs would be undertaken in national parks in the future because of:

- * a lack of expertise in weed control techniques
- * a lack of finances
- * a lack of staff

- * a reticence by park managers to use herbicides and other chemicals in natural bushland
- * a limited appreciation by park personnel of the impact of weeds on adjoining agricultural and farming lands
- * legislation constraints.

At the time of the last conference some of the above may have been applicable but during the interim ten year period weed control as a part of overall national park management has changed dramatically in all States, to the extent that protection branches addressing weed and pest animal problems are a major component of any National Park Service.

While ten years ago a lack of expertise may have existed and managers were reluctant to use chemicals in parks, the greater problem was that of a lack of options and alternatives in weed control techniques. Ten years ago agribusiness gave little consideration to the chemicals for use in national parks on the basis that the market was insignificant compared with that of agriculture, and that the cost and time of development of chemicals for weed control in native species conservation areas was prohibitive.

It was forecast at that time that this would rapidly change due to public awareness, expectations and demands, and would be further encouraged through environmental and pollution control legislation. Today we have a range of very effective chemicals of relatively simple chemical structure which can be used in native bushland areas with little risk of impact on the majority of native plant and animal species. The regular use of herbicides is now possible in most parks and hence the reluctance to use chemicals has past.

During the same ten year period the skills and expertise of many park managers has increased to the extent that considerable field weed research work is now undertaken by park personnel and the techniques of weed control developed in several parks are now being applied and implemented in other non-park bushland areas.

The limitations of staff and financial resources will always exist to some degree but these limitations are being reduced by increasing personnel skills, the evolution of detailed land resources inventories, and sound park management planning, based on ecological principles.

Legislation has and always will impose constraints and legal obligations on land managers, but it has been the interpretation of the various Acts and Regulations which has been the constraint, on weed control not the legislation *per se*. The new and amended Acts of the last ten years are now far more demanding of land managers but they will not limit weed control programs in parks any more than in the past. The even more recent Acts such as the various Planning and Environment Acts, the Occupational Health and Safety Acts, and amended Pesticides Acts will all require an even greater commitment to weed control planning in national parks.

MAJOR WEED PROBLEMS

The concept of a weed in the context of occurrence in a national park is somewhat different to that placed on the term 'weed' in an agricultural and local government area context. Any exotic species occurring in a national park is considered as out of place in the natural environment for which parks are established to preserve. An exotic is usually perceived as a European plant species, but an exotic plant in a national park can also be a non-indigenous native species and hence considered as a weed.

Many native species have extended their natural range through human disturbance and in some cases have adapted better to the new environment than their original occurrence range. For example, Cootamundra wattle, *Acacia baileyana*, which is now almost ubiquitous across the tablelands and slopes of southern N.S.W.

A further connotation of the term weed in the national park context, is that of an indigenous native species dominating a biophysical area or plant association to the extent of partial or total exclusion of other naturally occurring populations of a co-dominant. These plants become established as weeds due to mismanagement, or in response to a management strategy which enhances their growth potential. Because of many years of planned burning (prescribed burning/hazard reduction burning) a number of native 'fire weeds' now occur extensively in several national parks, and pose a specific 'weed' and vegetation management problem. The 'weed' control strategy developed must be one of integrating plant ecology/population dynamics with a fire regime(s) including fire frequency, fire intensity and the cumulative number of fires such that a specific vegetation trend back to a stable vegetation complex is achieved. Examples of 'weeds' in this context are fireweed, *Senecio lautus* and hop goodenia, *Goodenia ovata*.

These species rarely pose a widespread or major weed control problem but consideration must be given to them in the overall context of weed management in parks. It is the introduced herbaceous species which are the most widespread and major weed problem in parks e.g. St John's wort, *Hypericum perforatum* and serrated tussock, *Nassella trichotoma*.

Herbaceous weeds in national parks are not generally widespread over large areas of land, but are widespread along the access systems of many parks. The main tourist routes, car parks and picnic areas allow ready dispersal and establishment of exotic species; vehicles and people carry large numbers of weed propagules, while disturbance along roadsides and in recreation areas enhances the potential for germination and establishment of exotics at the expense of native species.

The roadside weeds are the most obvious to the public and land managers alike, and public and local government pressure has meant that most attention has been paid to the control and eradication of these infestations. While roadside weed control is an obligation on national park managers in the same way as that imposed on local government it has tended to dominate 'weed management' in some parks at the expense of control of more important weed problems.

In many coastal parks woody shrub species previously introduced for sand dune stabilization, as well as other garden escape plants and exotic landscaping plants are the most significant weed problems e.g. Bitou bush, *Chrysanthemoides monolifera*.

Appendix I contains a list of the distribution of weeds in national parks in south-eastern N.S.W.

NOXIOUS WEEDS IN PARKS

Only a small number of noxious plants are major problem weeds in national parks, e.g. serrated tussock, St. John's wort, blackberry, *Rubus fruticosus*, skeleton weed, *Chondrilla juncea*, this reflecting the orientation of past weed control regulations to that of agricultural and pastoral areas. It is only recently that several ornamental and garden escape plants which occur as major

weed problems in some parks have been listed as noxious species, e.g. privet, *Ligustrum vulgare*. Such species have been declared on the basis of their capacity for rapid and aggressive spread into natural areas, rather than on the potential impact on agriculture.

All national park managers recognise their obligation to carry out control of noxious species in the same way and under the same legislation which is operative for rural landholders in local government areas, although not being bound by the legislation. Control of declared noxious plants may not be a first priority in some parks as these weeds are often of lesser significance than undeclared species.

CONCEPTS OF WEED CONTROL IN NATIONAL PARKS

As with any public authority responsible for the care and management of public lands, the priorities for implementation of management strategies in national parks are determined by long-term conservation objectives for each individual area. The time frame in which these strategies are implemented is in turn determined by the human and financial resources available at any one time.

The first prerequisite to effective weed control programs in national parks is a very detailed weed and exotic plant survey. This may appear to be common sense but over very large tracts of natural lands such surveys have seldom been undertaken in the past as they are complex, time consuming and extremely costly in the short term. Fortunately detailed natural resource surveys are now carried out in national parks and include exotic plant surveys where these exist as weed populations.

These surveys identify the following:

- * the areas of high weed densities
- * source of weed seeds and propagules
- * the dispersal mechanisms such as streams, vehicular access points, or human movement pathways
- * identify possible future weed establishment areas e.g. future development sites
- * other major disturbance sites.

The dispersal mechanisms are an important consideration in planning control programs in parks. Vehicles are the main carrier of weed seeds into parks from surrounding rural lands and urban areas, but many major weed infestations are a legacy of land uses prior to the dedication of most national parks. In areas of high recreational use, weeds are readily established and are then spread inadvertently by people to other areas. Aggressive weed species which effectively compete with the stable natural vegetation and often establish in quite remote areas, are then readily spread further by creeks and rivers. For example, the tableland and coastal escarpment parks in N.S.W. encompass major water catchments, and high population weed infestations are now to be found along most streams to the very upper and lower limits of the catchments.

In the past 'cosmetic' control of such weeds has been undertaken for aesthetic reasons with little consideration being given to long-term control or eradication. In the past this approach to weed control may have been all that was possible under fiscal constraints, and without formal plans for weed control, but it is inappropriate today. It has in the past, satisfied park managers and the public alike as some weed control measures were seen to be regularly carried out. The 'must be seen to be doing something' philosophy was an acceptable approach in the 1970's but all facets of park management are

now under close and detailed scrutiny by the public and such weed control programs are now unacceptable. Continuing constraints, detailed natural resource data, and a requirement for ecologically based management makes planned and effective weed control both essential and achievable.

Weed control in most national parks must be, and generally is planned on a total catchment basis working from the upper reaches down to the lower levels over a number of years. The bottom lands of the catchments generally carry the most extensive weed populations as these areas are the deposition sites for seeds from plants dispersed higher in the catchments. These areas are observed by the public and weed inspectors alike as being the major weed infestations and hence pressure always exists for control measures to be implemented at these sites. However, as mentioned previously, control programs implemented in these areas achieve very little while seed deposition continues.

Weed control planned and carried out on a catchment basis seldom appears in the early phases (first 3-5 years), to be having any real impact on total weed infestations. Often weed populations in the lower reaches of the catchments may actually increase while upper catchment seed sources are being eradicated. The population increases may also be a response to the reduction in implementation of 'cosmetic' control measures at the lower levels in these years. This has often been perceived by adjoining rural landholders and local government authorities as the national park managers foregoing their commitment to weed control, while at the same time they are forced by legislation to control the same weed species where they occur on rural lands. This has led to some mistrust of park management by the rural community in some areas but in most situations this mistrust is due to a lack of understanding of park weed control strategies and programs.

The concerns of local government and rural landholders about the potential for weed spread to adjoining lands is recognised, but a planned long-term, effective weed control program is more appropriate than the perpetuation of the effective and wasteful programs carried out in the past, which have had no finite objective of eradication.

The implementation of weed control measures progressively down a catchment may be a long-term program, but it has greater potential for effective control and/or eradication. For such programs to be effective, full and on-going co-operation and liaison between adjoining landholders, local government and national park managers is essential.

Unfortunately this seldom occurs due to the impasse which so often develops between weed control personnel over the issue of the parks not being bound by the legal obligations imposed on local government and rural landholders. This situation should not arise as exotic species will always be of concern to park managers. These species have a significant impact on conservation objectives of all parks in the same way as they impact rural productivity, hence some control measures will always be implemented.

WEED CONTROL TECHNIQUES

Contrary to popular belief weed control techniques used in parks are generally the same as those used on rural lands.

During the 1960's and 1970's when the range of chemicals available for weed control in native vegetation in conservation reserves was limited, alternative techniques were developed and are now also used in many non-park areas where

environmental factors continue to conflict with widespread herbicide use. Bushland regeneration techniques which control weeds by physical removal of individual plants have been developed as most effective methods for woody shrub species particularly in remote areas, or where the populations are sparse. They are not appropriate for extensive or widespread weed populations.

Mechanical destruction of weed infestations is an integral part of roadside maintenance but is seldom very effective as disturbed road verges provide an ideal seed bed for vehicular dispersed weed seeds.

Ecological weed control is the most acceptable and appropriate control strategy in conservation areas but is seldom undertaken, as there is limited ecological and environmental information on even the most common weeds with respect to natural areas. There are some very good examples of ecological weed control in national parks, for example the extensive planting of native trees to shade out St John's wort in cleared land.

Biological control has potential for weed eradication in national parks as it has for some species on non-park lands, but concerns are held at present by park managers on the introduction of additional invertebrates, and diseases for the control of exotic plants but which themselves may pose other management problems in the future.

In N.S.W. the use of biological agents is strongly supported by the National Parks and Wildlife Service, particularly for control of blackberry. However, it is recognised that there is the possibility of adverse effects on other species of Rosaceae, some of which are native. The risks associated with these possible adverse effects must be adequately assessed before widespread release of any biological control agent into the vegetation of national parks.

The use of herbicides is still the most cost effective weed control strategy in most park situations, but the widespread use of chemicals in national parks still concerns the public. The long-term effects of some commonly used herbicides is not known, and their effects on non-target species must continue to be monitored. Such assessments may take many years, so in the interim all herbicides including the new and more environmentally acceptable chemicals, must be used with reservation and extreme care.

LEGISLATION AND WEED CONTROL OBLIGATIONS

While National Park Services' as government authorities are not bound by Acts which enforce weed control on local government and rural landholders, all national park managers recognise an obligation to carry out weed control particularly where there is potential for weed dispersal from a park to adjoining rural lands.

However, two Acts gazetted in recent years in N.S.W., do impose constraints and legal obligations on the N.S.W. National Parks management to carry out planned and safe weed control programs. These Acts are described below.

1. Environmental Planning and Assessment Act. This Act requires a review of environmental factors wherever a potential exists for an activity to have a significant impact on the environment. Weed control particularly the use of herbicides has such a potential in national parks where the impact on non-target species is not fully understood or quantified.

Where a significant impact potential exists the Act requires the preparation

of an environmental impact statement which must review and assess all effects which are considered significant. When the impact is established it does not necessarily mean that any proposed control techniques must be foregone. A control program can be continued but with modification to reduce the impact to acceptable levels.

The Act therefore places a heavy demand upon park managers to fully review any weed programs before implementation and this has tended to delay the start of some control programs of recent years. The requirements under the Act may be demanding with regard to reviewing impacts but this has the benefit of ensuring that any control or eradication program is properly considered planned and implemented on ecological principles.

2. Occupational Health and Safety Act. This Act places an obligation on all employers to provide a safe working environment, or provide such safety clothing and equipment as to negate any hazardous work areas.

Weed control particularly where herbicides are used poses a hazardous working environment and thus expensive protective clothing must be provided by an employer.

The Crown is bound by this Act and it has led to a considerable increase in the costs of control programs. This Act has also enhanced the planning and implementation of many weed control programs in N.S.W. parks and together with the Environmental Planning and Assessment Act has contributed to more effective weed control strategies which will in the future benefit the rural and urban lands adjoining parks.

Similar Acts to these are operative in the other states.

DISCUSSION

A very large number of exotic and introduced species currently exist in national parks, the number and individual species varying with the biophysical characteristics of the landscape of each park. A large proportion of any weed population can be identified as having been a component of the flora complex prior to the establishment of any park. These weeds reflect the period and form of past land use of the park areas and unfortunately have left the park managers with a legacy of weed problems.

The increasing environmental awareness of the public in the late 1970's and 1980's has brought about the introduction of new legislation which has influenced and benefitted the planning and implementation of weed control programs but it has also led to increasingly high recreational use of national parks and equivalent conservation areas. The movement of people and vehicles into and through parks has provided a dispersal mechanism for propagules of existing weeds as well as several new species not previously recorded in parks e.g. *Parthenium* weed, *Parthenium hysterophorus*.

Control of these weeds has posed a major management conflict for national park managers, as the use of herbicides has been limited to a small number of chemicals considered appropriate for use in natural bushland in conservation areas. This situation is changing with the development of herbicides for such areas which appear potentially to have little or no long-term impact on native plant and animal communities.

It is recognised that weed management in national parks is integrally tied to native vegetation management and with feral animal control. Few exotic

species are aggressive enough to compete with a stable native vegetation complex, but most weeds are able to colonise disturbed areas. Where recreational demand and use exists, disturbance of the native vegetation occurs and weed establishment follows. These areas are along roads, tracks, picnic areas and sites of park infrastructure. The latter sites are often non-National Park Services' facilities used by other authorities within a park, such as water supply, electricity supply and hydro-electric facilities and hence the weed management programs must be co-operative programs with other park users. Unfortunately many of these sites are linear areas, of disturbed native vegetation and weed occurrence providing an avenue for further widespread dispersal through a park in which these facilities exist e.g. power line easements.

Exotic and feral animals particularly those such as pigs which destroy extensive areas of stable native vegetation in quite remote areas provide disturbance sites and a potential for the rapid establishment of weed species. The control of pigs is obviously an essential element in effective weed control and adds considerably to the cost of weed control in parks. The combined programs demand a full and detailed appreciation of the natural resources and the distribution of weed and feral animal populations as a prerequisite to the implementation of control strategies.

Bushfires while a process in the natural environment enhance the weed problem particularly when fire occurrence is increased by the activities of park users. The 'fire problem' is further exacerbated in some parks where prescribed burning for the reduction of hazardous fuels and the impact of wildfire on life and property, is imposed on a regular and short rotation basis. Prescribed burning is itself a disturbance factor reducing the vegetative cover and exposing large areas to weed spread and establishment. A major management conflict therefore exists between the need for prescribed burning for the reduction in the potential for high intensity bushfires to spread from a park to rural lands and any weed management program. The relative impact potential of weed and fire spread from a park to adjoining local government and rural lands must be assessed and quantified to ensure both are constrained to acceptable levels without compromising conservation objectives. In this assessment the legal obligations of local government and the rural constituents is acknowledged by park managers and every endeavour is made to implement complementary weed control programs along main access roads which traverse the park and local government boundaries.

Most National Park Services' or their equivalent organisations are now carrying out detailed data collection of natural resources and have established or are establishing computer based management models to enable the effective integration and implementation of vegetation, fire and weed management programs. The predictive modelling of weed populations and weed dispersal routes will in future years provide an even greater input to sound and effective weed control programs in national parks and conservation reserves.

APPENDIX 1

DISTRIBUTION OF WEEDS IN NATIONAL PARKS IN SOUTH EASTERN N.S.W.

A recent survey of the distribution of weeds in national parks in south-eastern N.S.W identified the following species and their dominant sites of occurrence, providing for the following classification. The list is far from complete as not all parks were surveyed but the list serves to indicate the species and the areas where weeds are a problem.

1. Introduced amenity weeds

* Woody shrubs and trees

Poplars	<i>Populus</i> spp.
Birch	<i>Betula</i> spp.
Ash	<i>Fraxinus</i> "raywoodii"
Willows	<i>Salix</i> spp.
Alders	<i>Alnus</i> spp.
Privet	<i>Ligustrum vulgare</i>
Boxthorn	<i>Lycium</i> spp.
Broom	<i>Sarothamnus, spartium</i> spp.
Tree of Heaven	<i>Ailanthus altissima</i>
Pines	<i>Pinus</i> spp.

* Temperate grasses and legumes

Ryegrass	<i>Lolium</i> spp.
Cocksfoot	<i>Dactylis glomerata</i>
Bent grass	<i>Agrostis tenuis</i>
Fescue	<i>Festuca rubra</i>
Yorkshire fog	<i>Holcus lanatus</i>
Vetches	<i>Vicia</i> spp.
Clovers	<i>Trifolium</i> spp.

* Garden escapes

Privet	<i>Ligustrum vulgare</i>
Lantana	<i>Lantana camara</i>
Pines	<i>Pinus</i> spp.
Gorse	<i>Ulex europaeus</i>

* Escapes from revegetation and rehabilitation programs

Bitou bush	<i>Chrysanthemoides monolifera</i>
Temperate grasses and legumes	

2. Roadside, stock route and stock camp weeds

Mullein	<i>Verbascum thapsus</i>
Mustard	<i>Diploaxis tenuifolia</i>
Melilotus	<i>Melilotus alba</i>
Milfoil	<i>Achillea millefolium</i>
Skeleton weed	<i>Chondrilla juncea</i>
Fleabane	<i>Erigeron bonariensis</i>
Paterson's curse	<i>Echium plantagineum</i>
Blackberry	<i>Rubus fruticosus</i>

St Johns Wort	<i>Hypericum perforatum</i>
Sweet Briar	<i>Rosa rubiginose</i>
Thistles	<i>Cirsium, Carthamnus, Onopordum,</i> <i>Carduus spp.</i>
Serrated tussock	<i>Nassella trichotoma</i>
Parthenium weed	<i>Parthenium hysterophorus</i>
Temperate grasses and legumes	

3. Weeds of historic and cultural sites

Lupins	<i>Lupinus spp.</i>
Oxalis	<i>Oxalis spp.</i>
Hawthorn	<i>Cretaeagus laevigata</i>
Sweet Briar	<i>Rosa rubiginosa</i>
Privet	<i>Ligustrum vulgare</i>
Boxthorn	<i>Lycium spp.</i>
Aloe	<i>Agave americana</i>
Serrated tussock	<i>Nassella trichotoma</i>
Thistles	
Nettles	
Temperate legumes and grasses	

4. Water weeds

Cumbungi	<i>Typha orientalis</i>
Dock	<i>Rumex spp.</i>

5. Cosmopolitan and naturalised weeds

Dandelion	<i>Hypochoeris radicum</i>
Catsear	<i>Taraxicum officinale</i>
Sorrel	<i>Rumex acetosella</i>

6. Native plant weeds

* Non-indigenous species

Wattles	<i>Acacia baileyana</i> <i>A. saligna</i> <i>A. armata</i>
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* Native fire weeds

Groundsell	<i>Senecia lautus</i>
Daisy bush	<i>Olearia stirlingii</i>
Daviesia	<i>Daviesia mimosoides</i> <i>D. latifolia</i>
Hop Goodenia	<i>Goodenia ovata</i>